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at other oppositions, give not the slightest trace of any such variation. Consequently the time of rotation of 7·92 hours deduced by him must be regarded as unsupported by observation.

(2) The observed magnitude of Neptune in mean opposition is 7·99 on the system of the Potsdam *Durchmusterung*, showing, in extremely satisfactory agreement with Müller's value 7·97, and Pickering's value 8·00.

In conclusion, I wish to record my thanks to Professor Müller, at whose suggestion these observations were made, for the interest which he has shown throughout this work.

Astrophysical Observatory, Potsdam:
1908 *June* 6.

Observations of helium D_3 absorption in the neighbourhood of Sun-spots in 1907. By Captain R. A. C. Daunt, D.S.O.

The following observations of D_3 absorption in the neighbourhood of sun-spots were made with a 3-inch equatorial refractor and a large Thorp, prism-grating spectroscope, 15,000 lines to the inch, the eyepiece ordinarily employed being a Steinheil monocentric 20 m/m power 52. The identification of the several groups according to the Greenwich numeration will, it is hoped, be of service for comparison with spectro-heliographic and cognate studies of the same groups. In Table I. the numbers of the various groups and the dates on which they were observed are given, as well as the type or phase in the life-history of the groups at the times of observation, according to the classification of Father Cortie in his paper "On the Types of Sun-spot Disturbances," *Astrophysical Journal*, xiii., 4th May 1901.

In all the cases of absorption of D_3 observed, the dark line was never seen over the umbræ or penumbræ of the spots of any group, but between the spots, or on the photosphere in their neighbourhood. It would appear that some of these groups showed D_3 in absorption on certain days only, and not on others. This may be real; but as the appearance of D_3 is very intermittent, it is more likely to be due to the hour of observation; and had I been able to keep the groups under observation throughout the day, D_3 would probably have been seen near the spots some time or other of the day during the apparition, provided the groups remained active and agitated.

In Table II. are given the Greenwich numbers of those groups in the neighbourhood of which D_3 was not observed. For the reason stated above, some of these groups may have shown the absorption effect of D_3 at some time, but it was not observed.

As, however, most of these spots were small, or of a regular and quiescent nature, it is perhaps unlikely that D_3 was reversed.

A table follows showing the proportion of the total number of fresh groups observed each month with those that showed D_3.

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There would appear to be a discrepancy here, and the proportions as shown by the Greenwich numbers appear to be higher. This is due to a different system of numbering. For instance, the group consisting of the Greenwich Nos. 6075, 6076, 6081, 6085 has for the purposes of the table been counted as one group. This is, I think, under the circumstances, more accurate, as by the Greenwich numbers it would appear that four different groups showed D_3 in absorption, whereas these spots were obviously part of one disturbance, and should only be counted as one disturbance for this purpose.

Table I.

Group in which D_3 was observed as a dark line.

Greenwich No. of Group.	Dates of Observation.	Type of the Group.
	1907	
6059	Jan. 2, 3	IV$_b$
* 66	,, 3	IV
67	,, 3	III
70	,, 3	I
75 * 76 81 85	,, 16	III$_b$
94	,, 24	III$_a$
6099	,, 30, Feb. 4	III$_a$, IV$_b$
6100	,, 30, ,,	III$_a$, IV$_b$
* 03	Feb. 4, 5	III, IV$_b$
04	,, 4, 5, 11	I, III$_b$, III$_a$
* 08	,, 9, 11, 13, 16, 17	V, III$_a$, III$_a$, V, V
* 36	Mar. 3, 4	IV$_b$, IV$_a$
37	,, 4	III
39	,, 5, 6	IV$_b$, IV$_b$, IV$_a$
* 40	,, 5, 6, 14, 17	IV$_b$, IV$_a$
50	,, 22	I
55	,, 23	IV$_e$
* 56	,, 30	I
58	Apr. 4	III, IV
59	Mar. 31, Apr. 2, 4, 9	IV, III$_a$, III$_a$, IV$_b$
68	Apr. 15, 16, 17	I, I, II
72	,, 21, 23, 29	III, IV$_b$, IV$_a$
75	,, 26, 27	I, I
81	May 4, 5, 6	III, III, IV$_a$
* 84	,, 4, 5, 6, 14	IV$_e$, IV$_e$, IV$_e$, IV$_e$
6185	,, 13, 14	III$_a$, III

TABLE I.—*continued.*

Greenwich No. of Group.	Dates of Observation.	Type of the Group.
	1907	
6187	May 14, 16, 17	I, II$_c$, III
6188	,, 14, 16	III, II
6230	Aug. 5	I
31	,, 5	I
36	,, 18, 23, 24	III, IV$_b$, IV$_b$
* 38	,, 24	IV$_a$
39	,, 23	IV$_b$
* 41	,, 30, Sept. 6	III$_a$, III$_a$
43	Sept. 6	IV$_b$
45	,, ,,	I
47	,, ,,	III
55	,, 20, 21	I, I
56	,, 22	IV$_a$
59	,, 20, 21, 22, 25, 26, 27, 29	III$_b$ . . . . III$_a$
60	,, 20, 21, 22, 26	IV$_a$, IV$_d$, IV$_d$, IV$_d$
62	Sept. 20, 21	IV$_a$, IV$_d$
65	,, 25, 26, 27, 29	III$_a$ . . . . III$_a$
68	,, 27, 29	I, IV$_b$
70	,, 29	I
75	Oct. 9	I
76	,, 9, 13, 14, 16	I, III . . . . III$_a$
77	,, 9, 13, 14, 16	I, III$_a$ . . . . III$_a$
78	,, 13, 14	III$_a$, III$_a$
79	,, 9, 14, 16	I, IV$_c$, IV$_b$
81	,, 14, 16	IV$_c$, IV$_b$
82	,, 14, 16, 19, 23, 24	IV$_b$, IV$_e$, IV$_b$, IV$_b$, IV$_b$
* 83	,, 14, 16, 19, 23, 24, 26, 27	III$_a$ . . . . IV$_e$, IV$_c$
* 84	,, 16, 19, 23, 24, 26, 27	III$_a$ . . . . IV$_e$, IV$_c$
85	,, 19, 23, 24, 26, 27	III$_a$ . . . . IV$_e$, IV$_c$
* 89	,, 23, 26, 27, Nov. 1	IV$_a$, IV$_b$, IV$_b$, I
91	Nov. 1	II$_c$
6292	,, ,,	I
*6316	Dec. 2, 3	IV$_b$, IV$_b$
18	,, 6, 7, 9	IV$_a$, IV$_a$, IV$_a$
* 19	,, 6, 7, 9, 12, 14	IV$_b$ V
20	,, 9	III
* 21	,, 9, 12	IV$_b$, II$_a$
23	,, 14, 18	I, II$_c$
6324	,, 18	IV

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An asterisk denotes that the group so marked was the return of a former group. The appearance of the absorption-line in the cases observed was lumpy, patchy, broken, and thickened, sometimes distorted towards the violet, as in groups 6259, 65, 68, and once, in groups 6283, 84, distorted towards the red. Group 6137, March 4th, 10·30 G.M.T., furnished the most remarkable appearances of D_3 absorption observed since those of the big spot of July 1906. The appearance of dark D_3 as a fine continuous dark line has not been recorded.

In every case of observation of reversal of D_3 the C line of hydrogen was sympathetically affected, being twisted and lumpy, distorted towards the red and the violet, accompanied by brilliant reversals, sometimes over considerable areas in the neighbourhood of spots, as in the groups 6283, 84, 85, Oct. 21, when, too, the sodium lines D_1 and D_2 were reversed.

Magnificent reversals were seen in group 6103, Feb. 5th, when a large prominence arising amongst scattered spots could be traced across the disc and out beyond the limb. In group 6188 the line was thick, with black lumps and bright reversals in the faculæ surrounding the group, and in group 6247 violently disturbed, greatly distorted to the red and violet, and very lumpy, with brilliant reversals.

Table II.

List of Spot-groups in which the D_3 line was not observed.

Greenwich No.	Type.	Greenwich No.	Type.
6061	I	*6113	IV, I
62	I	* 15	I
68	I	* 17	IV
* 74	I	18	III
77	IV*a*	19	I
79	I	20	I
* 86	I	21	I
* 87	IV*a*, I	* 23	IV
88	IV*b*	27	IV, I
* 90	IV	28	I
93	I	29	I, III
97	I	31	I
*6098	IV, I	33	I
6101	IV, I	34	IV
02	I	35	I
* 05	I	38	I
07	IV*a*	45	I
09	I	46	I
11	I	52	I
*6112	I	*6153	I

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TABLE II.—*continued.*

List of Spot-groups in which the D_3 line was not observed.

Greenwich No.	Type.	Greenwich No.	Type.
*6154	I	*6246	I
* 61	IV	48	I
64	IV, I	61	I
65	I	63	IV, I
70	I	64	I
74	I	* 67	IV
*6189	IV	69	I
6220	IV	71	IV
23	I	72	I
25	I	* 73	IV
26	IV	* 80	IV
27	I	*6288	I
29	I	6317	I
32	IV	18	IV
34	IV	22	I
37	I	25	I
6240	I	6326	I

TABLE III.

Showing the proportion of Spot-groups which showed D_3 reversed.

Month.	No. of Days of Observation.	Total No. of Groups observed.	No. of Group in which D_3 Dark.	Percentages.
Jan.	7	21	7	33·3
Feb.	9	18	3	16·7
Mar.	17	21	7	33·3
Apr.	12	13	4	30·8
May	7	6	5	83·3
July	1	4	0	—
Aug.	5	14	6	42·9
Sept.	8	17	9	52·9
Oct.	11	18	7	38·9
Nov.	1	1	1	—
Dec.	9	11	5	43·6
Totals	87	144	54	Percentage on the Totals 37·5

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[*Note added by Father Cortie, S.J.*]

In the above tables I am responsible for the columns headed "Type of the Group," using for the information therein contained, with the kind permission of Captain Daunt, the materials in his observing note-book, the Stonyhurst sun-spot drawings, and the useful monthly "Tables and Notes on Sun-spots" compiled by Mr. Maunder for the *Observatory*. The object of these columns is to ascertain whether the phenomenon of D_3 absorption is confined to, or generally favours, any particular phase in the life-history of sun-spot groups. The more active phases of sun-spot development are represented by Type II. and Type III., and 39·7 per cent. of the groups in which D_3 was observed as a dark line were of these types. In the life-histories of spot-groups it is generally the following part of the group which disappears first, leaving a single spot, with accompanying small companions. This phase, represented by Type IV. with various suffixes, is also largely represented in Table I.; and in his notes on the D_3 reversals, Captain Daunt frequently records that the absorption was observed between the two main spots of a group of Type II. or Type III. form, or in regions following the main spot, that is, in the earlier phases of Type IV. Therefore it follows that in general the phenomenon is indicative of violent local action in the earlier phases of the life-history of groups. However, it is not entirely confined to these phases, as it is recorded in groups 6256 and 6318, examples of round steady spots. But even in these cases, 6256 had a divided nucleus and showed signs of disruptive change, and group 6319 in the neighbourhood of group 6318 was disturbed. The table giving the groups in which D_3 was not observed shows that the spots were in the last stages of their life-history, being in most cases either round steady spots or scattered remnants of groups. But here again there are exceptions, as group 6118 was being developed, and group 6129 passed through an active stage, though on a small scale.

Stonyhurst College Observatory.

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Lengths of Axes and Position Angles of 52 Oval Nebulæ.

By Dr. Max Wolf.

Professor Turner has suggested the question whether there is a relation between the apparent form and the situation of oval nebulæ of the type of the Andromeda nebula, viz. Is the ratio of the two axes of the ellipse, visible to us in projection, connected by some rule with the position angle of the major axis?

I have made a first trial with the oval nebulæ of my last catalogue,* putting these together in the following list. The lengths of the two axes *a* and *b* are estimated on the plates by a scale in the eye-piece of my microscope; the position angles are estimated with the aid of a cardboard circle at the same.

The visible dimensions of such diffused objects depend in a high degree upon the exposure, the darkness of the plate, the illumination, and the position on the plate, so that the lengths of the axes are affected with some uncertainty. Notwithstanding, there is no doubt that some simple rule, if it exists, must be perceivable from these numbers.

The distribution of the position angles themselves has a maximum at about 30°, and a second fainter at about 160°.

Kgst. Liste 8. No.	N.G.C. No.	α 1875. h m s	N.P.D. 1875. ° ′ ″	Pos. Angle. °	*a* ″	*b* ″
111	3935	11 45 55·2	56 54 0	110	45	20
130	new	47 13·9	56 32 0	40	20	15
132	,,	47 15·6	60 3 3	105	45	20
138	,,	47 22·5	55 56 12	130	60	30
154	,,	47 49·7	56 26 35	160	45	12
173	,,	48 51·5	56 9 34	160	20	6
177	,,	48 57·2	56 10 38	80	20	8
193	,,	49 19·4	59 21 47	40	60	15
213	,,	49 53·7	57 52 51	10	60	15
216	,,	49 56·2	57 15 55	135	45	15
232	3986	50 17·2	57 17 0	100	100	20
255	new	51 2·1	58 13 6	165	30	12
257	,,	51 3·8	56 58 12	30	45	10
258	3991	51 5·2	56 57 55	15	15	10
263	3994	51 10·3	57 1 40	10	30	15
271	3995	51 17·2	57 0 37	(?) 30	90	30
303	4020	52 30·8	58 53 23	15	80	20
318	new	52 47·1	58 34 15	140	30	15
346	,,	53 42·6	56 10 0	35	30	12
352	,,	11 53 50·7	58 4 44	45	40	15

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* *Königstuhl Nebel-Liste* No. 8, Publ. iii.